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Professor Michael Redhead FBA

15.2.98

Dear Katinka,

In response to the new reply of the second referee, I suggest we e-mail Van der Merwe along the following lines:

"In order to meet the points raised in the new reply of the second referee, we suggest making the following adjustments to the paper:

Point no 1 : We propose re-writing para 1 of p-16

as follows:  
We disagree with Spalar: the first stages of the spin-echo experiment do not show the behaviour we normally take ourselves to be explaining; it is true equilibrium, not apparent equilibrium which is typical of thermodynamic behaviour. This is illustrated by the case of an vibrating

II

Coarse-grained. Such a person will predict the wrong results. Suppose she just walks by and happens to see the system at the moment the free induction signal has died out and the second rf pulse has been applied. She will then predict that the system will remain in the apparently disordered state; but in fact, of course, the system will return to a state ~~one~~ with all the spins axes aligned along the same axis, so that the echo signal is emitted. The echo will come as a complete surprise to the coarse-grained. For the interventionist the echo is no surprise at all, since he knows that the system has been prepared in a very special way (that minimizes the effect of interventionist perturbations).

The kind of thermodynamic behaviour we would like to explain using statistical mechanics is the behaviour which leads to ~~leads to~~ the usual situation in which an innocent observer unaware of the history of the system will actually make the right prediction, namely that the system is going to stay in the equilibrium state for all future times. It is these states which can truly be called equilibrium states.

Point no 2 We propose adding the following comment at the end of para 1 on p. 10:

\ We do not claim, of course, that it is a virtue of our model that it is a mixing system and has no strong ergodic properties. On the contrary, our remark about the infinite times the system needs to reach the equilibrium state points to the problematic aspects of approaches based on mixing properties, since we are convinced that statistical mechanics should reproduce the finite relaxation times we find in real thermodynamic systems. The intermediate approach we defend later in the paper makes no reference to ergodic theorems, and may be expected to produce more realistic relaxation times to true equilibrium even for mixing systems. (In general we reject ergodic approaches since they do not appear to be relevant for realistic systems.)

#### IV

Point no 3 para 2, p. 17, we propose

simply omitting the last sentence, which  
the referee feels might be a source of  
confusion.

Point no 4 (final paragraph of referee's  
reply). We suggest the following

new paragraph to be inserted just  
before the last paragraph of p. 19:

Effectively the system is 'exporting' its correlation  
to its environment, but, of course, the argument  
can be repeated for the larger system

consisting of the original system under

investigation, and its immediate environment,  
which will also exhibit an increase in  
fine grained entropy, due to perturbations from  
the 'environment of the environment'.

But, finally the question arises what the  
implications of the interventionist approach are

for the universe as a whole - - - -

We trust these amendments meet with your approval, etc etc "

## V

let me know what you think, and  
prepare a suitable e-mail for  
Van der Meer.

(By the way I have noted one  
typo on p. 19, 2 lines from end of  
penultimate paragraph; delete final 's' from  
'systems'.)

With best wishes

Michael

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